

valde sulcata, sulcis transversim excavato-punctatis, eorum marginibus crenatis; apertura dilatata; margine columellari antice oblique truncata; labro semicirculari, postice parum producto et rotundato.

Hab. Tsu-Sima; 30 fathoms: Korea Strait; 46 fathoms.

No species has been described resembling this, which is nearly as large as *P. Coreanica*. The edges of the transverse grooves are conspicuously crenate, and the puncta or pits are transversely oblong.

3. *Philine acutangula*, A. Adams.

P. testa subquadrato-ovata, alba, tenui, postice subtruncata, transversim sulcata, sulcis excavato-punctatis; anfractu ultimo lateribus subparallelis; apertura aperta; labro margine semicirculari, angulo ejus postice incurvato, producto et acuto.

Hab. Gulf of Lian-tung; Hulu-Shan Bay.

The nearest approach to this species is *Ph. scutulum*, Lovén; but the produced sharp hind angle of the outer lip will serve readily to distinguish it.

4. *Philine striolata*, A. Adams.

P. testa parva, ovata, alba, tenui; semipellucida, postice rotundata, longitudinaliter plicata, transversim striolata, striolis confertis, subtilissimis; apertura dilatata; margine columellari arcuato; labro regulariter semicirculari, postice producto, rotundato.

Hab. Tsu-Sima; 30 fathoms.

In form this little species most nearly approaches *Bullæa pruinosa*, Clark, from the British Seas; but in sculpture it is entirely different, being very finely transversely striated.

Shanghai, China,
May 15, 1861.

BIBLIOGRAPHICAL NOTICES.

Forest Creatures. By CHARLES BONER, Author of 'Chamois-Hunting in the Mountains of Bavaria,' &c., &c. Small 8vo. London: Longman, 1861.

THAT an intimate connexion should exist between the chase and the study of natural history is not surprising. From the time when the conqueror of Arbela bade the Nimrods and Gordon-Cummings of his generation bring their hunting trophies and experiences to the Stagyrte sage, this connexion seems to have lasted down to our own day, which has seen the works of Mr. A. E. Knox and the late Mr. Charles St. John—men whom one hardly knows whether to regard as scientific sportsmen or sporting men of science. To such a class

belongs the author of the modest little octavo whose title stands at the head of this article. If Mr. Boner has failed to express himself so happily as the writers we have just named, and to invest the subjects and scenes he describes with the absorbing interest that pervades their works, it is for reasons of which, as critics from a zoological point of view, we need not complain, but prefer leaving his occasional faults of style to our more exclusively literary brethren. The author says in his preface, that he wishes it "to be understood that the book is wholly without scientific pretension;" but we must remark that its scientific merits are no less present because they are unassumed.

The animals treated of in 'Forest Creatures' are seven in number, namely, the Wild Boar, Roe, Red and Fallow Deer, Capercally (we prefer the spelling of the old Scottish law-books to our author's "Capercailie," or to the more common, more inconvenient, and equally un-English "Capercailzie"), Black Grouse, and Golden Eagle. There is also a chapter headed "Homer a Sportsman," which might be read with pleasure even by Mr. Gladstone; and another of "Hints," which might be read with profit even by Mr. Grantley Berkeley.

In England we are apt to imagine that none but our own countrymen have any right to be regarded as sportsmen. Our vanity has been flattered by amusing sketches and descriptions of fully-armed Frenchmen engaged in the pursuit of skylarks, or of a band of German students discharging a volley at a covey of partridges, from which, on the consequent fall of a single victim, the whole body of jägers would forthwith burst into a joyous hunting-song, to the astonishment of the British spectator. Mr. Boner's book may help to correct these grossly exaggerated notions, and serve to show that there is as much true sportsman-like feeling in Germany as in England. Indeed, it may be shortly said that sporting is peculiar to no age and to no nation.

But we must limit our remarks in this direction, and apply ourselves more especially to the zoological points of interest in the work we are noticing. Mr. Boner's account of the Wild Boar is especially deserving of attention; for in no modern English works are the peculiar habits of that "knightly beast" described. Quite recently also, doubts, apparently well founded, have been expressed as to whether or not our domestic swine have descended from the wild *Sus scrofa**, which even now has an extensive range throughout Europe, though there is, we believe, no record of its existence in England since the time of the first Plantagenet king, some seven hundred years ago. The Boar seems to be somewhat of a favourite with our author; and a well-executed representation of its head—no inappropriate device at this season of the year—glows on the green cover of his work.

We beg leave to draw the attention of physiologists to what is recorded of the Roe-deer by Mr. Boner. He announces, as "a new wonder in natural history," a discovery which he says has been

* See Mr. Bartlett's "Remarks on the Japanese Masked Pig," reprinted in our last volume (pp. 501, 502) from the 'Proceedings of the Zoological Society' for 1861, pp. 263, 264.

made by Professor Bischoff, of Munich, respecting the conception and gestation of that species. It is stated that—

“The rutting-season of the Roe is at the end of July and in August, this being the only time when the organs of the male and female are in such a state as to make procreation possible.

“In a few days, at most, after the rutting, the egg progresses in the usual way through certain channels—a process unnecessary to describe here,—and then arrives in the uterus; and here, *without undergoing any change whatever*, it lies dormant $4\frac{1}{2}$ months.

“In this undeveloped state it had always been overlooked by naturalists; moreover, as the uterus remains also quite unchanged, the belief that the doe was not pregnant seems to be confirmed.

“As will be remarked, all the circumstances were such as to mislead the investigator, and to incline to false conclusions.

“But in the middle of December the germ, which had been lying so long inactive, suddenly quickens, and, with the same fast progress as is observable in other Mammalia, develops so considerably, that in from twenty-one to twenty-five days all the parts of the egg and all the organs of the embryo are so formed as to undergo no further change before birth, except an increase in size.

“The different gradations in the development of the embryo, the various appearances which present themselves in the more or less advanced stages of growth, have been omitted as quite unnecessary, and, to many a reader, wholly unintelligible. These, however, have all been circumstantially noted down, and drawn with the strictest accuracy; and, moreover, the delicate germ and its infinitesimal tendril-like offshoots have been preserved, so that their progress towards maturity may be followed day by day and week by week, and the eye of the uninitiated, even, behold and comprehend what once Science alone could see.

“And for such discovery, and clear display of it, we are indebted to Dr. Louis William Bischoff, at this moment Professor at the University of Munich*” (pp. 44–46).

Now the extraordinary circumstance above related is not entirely new to English naturalists, though it may be so to many of our readers, for no comprehensive work on British Mammals has been published since those of Prof. Bell and Prof. MacGillivray, which appeared, the one simultaneously with, the other but shortly after Prof. Pockel's paper in Müller's ‘Archiv’ for 1836, wherein attention was first directed to the subject. Yet, if we are not mistaken, the discovery of the distinguished Bavarian physiologist has been noticed in some of our scientific journals; and we believe that the proof of his theory is considered satisfactory. However, we look forward to Prof. Bell telling us all about it in the new edition of his ‘British Mammalia,’ which is understood to be in preparation.

Two chapters are devoted to the Red-deer; and a subject which

* “In case any of my readers should be desirous of studying the subject with more scientific accuracy than it is possible to do from this sketch, the title of Prof. Bischoff's treatise is subjoined: ‘Entwicklungsgeschichte des Rehcs.’ Giessen, 1854.”

has not, that we are aware of, hitherto received much attention from naturalists is very fully treated. This is the fact that the 'slot' or footprint of the animal reveals to the practised eye a faithful indication of its age, sex, size, and condition. Of course all this is well known to every good forester, but we are ignorant of any work in which the particulars are recorded; and here numerous illustrations are introduced, serving to explain the differences which may be observed. The Fallow-deer comes next in the book, but this theme is less dwelt upon; and then a few pages are occupied by the Capercally and Black Grouse, without any new facts in their history being, we believe, alleged, though Mr. Boner graphically describes the scenery of their haunts, and the methods employed of shooting the cocks of both these fine birds in the season of courtship—undoubtedly an unsportsmanlike practice, according to English notions, but one which, from their polygamous habits, may be indulged in without fear of too much diminishing the stock, and which, from the great extent of the German forests, added to the desultory wanderings of the birds at other periods of the year, is almost rendered necessary.

We cannot afford space to dwell on the Eagle-nesting exploits of Count Arco, who seems to possess the combined powers of MM. Blondin and Leotard, so great is his skill in balancing and leaping. An account of this gentleman's great feat at Rohrmoos has already been published in the English newspapers*. We can only regret that the custom of Eagle-destroying, which has even now deprived the Highlands of Scotland of so much of the ornithological interest they formerly possessed—and this without any great advantage to the sportsman—has been extended to South Germany. If Eagles' nests were always placed in the dizzy situation represented in Mr. Boner's frontispiece, we might rest assured that, in the absence of an enemy endowed with Count Arco's perseverance and gymnastic accomplishments, they would be pretty safe; but we fear the selection of such almost impregnable fortresses is rather the exception than the rule.

The illustrations to 'Forest Creatures' are well designed by the artist; but, we are sorry to say, the wood-cutter has done his best to spoil the spirit shown by the draughtsman, by his extremely clumsy execution. Should this little book, as it certainly deserves, attain the honours of a second edition, the publishers will do well to have the figures re-engraved.

Some naturalists there may be who will say that works like this of Mr. Boner's are of no scientific use, but are merely fit to amuse fox-hunting gentlemen during a frost, or shooting squires in showery weather. With such opinions we decidedly disagree, and recommend to their notice a little anecdote related in pages 219, 220 (whether it is true or not does not in the least signify), which the author introduces by the remark, "A trifle, if it be seen by one, even the most uncultivated, who understands the technical peculiarity, and knows what inference is to be drawn from it, may throw sudden light

* Vide 'The Field' for June 8, 1861.

on a subject, and clear up that which was before shrouded in mystery." Herein lies the explanation of the utility of all field-observations.

Report on the Geological Survey of the State of Iowa. By JAMES HALL (State-Geologist) and J. D. WHITNEY (Chemist and Mineralogist). Vol. I. Part 1. Geology; Part 2. Palæontology. Iowa, 1858.

In 1812 was published (in the 'Journal de Physique' for February) the first geological map of the United States of America, by William Maclure; and this was improved and republished at Philadelphia in 1817. Other independent observers, among whom were A. Eaton, L. Vanuxem, S. G. Morton, I. Lea, G. W. Featherstonhaugh, and W. Darby, continued to advance the knowledge of the geology and palæontology of the United States until about 1835, when considerable impetus was given to geological research by two circumstances:—firstly, Murchison's elucidation and arrangement of the Silurian strata, and the consequent clear systematization of the Palæozoic rocks in Europe and America; and secondly, the institution of special geological surveys by the Governments of several of the States of the North American Union and by the Federal Government itself,—the national importance of geological maps and reports having been recognized by the United States and by the English Governments at about the same time.

The geological surveys of the following States were commenced about this period:—Maine (C. T. Jackson), New Hampshire (C. T. Jackson), Vermont (Z. Thompson and C. B. Adams), Massachusetts (E. Hitchcock), Rhode Island (C. T. Jackson), Connecticut (C. U. Shepard and J. G. Percival), New York (W. W. Mather, E. Emmons, L. Vanuxem, J. Hall, J. E. Dekay, L. C. Beck, and T. A. Conrad), New Jersey (H. D. Rogers), Pennsylvania (H. D. Rogers), Delaware (J. C. Booth), Maryland (J. T. Ducatel), Virginia (W. B. Rogers), Ohio (W. W. Mather), Tennessee (G. Troost), Indiana (D. D. Owen), and Michigan (D. Houghton). Most of these State-surveys have been prosecuted with vigour by the geologists above named and others, and have been productive of good maps and memoirs, and of valuable collections and descriptions of fossils and minerals. Subsequently the State of Kentucky was preliminarily examined by L. P. Yandell and B. F. Shumard in 1846, and geologically surveyed by D. D. Owen in 1854–55; and Missouri has been reported on by G. C. Swallow. The States of Wisconsin, Minnesota, Iowa, and Illinois were geologically explored by D. D. Owen in 1839–52; Wisconsin by the late J. G. Percival in 1854; and Iowa was more specially surveyed by James Hall and J. D. Whitney in 1855–57, and the results of their labours are published in the Report before us. Previous to making any remarks on this work, we may mention that in the Southern States geological surveys have been established, —in North Carolina (D. Olmsted and E. Emmons), South Carolina (M. Tuomey and O. M. Lieber), Alabama (M. Tuomey), Georgia

(G. White), and Mississippi (B. L. Wailes); that Arkansas has been reported on by the late eminent geologist, D. D. Owen (1857-60); Texas is under examination by B. F. Shumard, and Illinois by A. H. Worthen; and that the geological constitution of the Western Territories of the United States has been learnt chiefly by means of the various expeditions, exploring, surveying, and military, undertaken since 1840.

Few of the State-surveys, except those of New York and Pennsylvania, rival in their results that of Iowa, whether we look to the elucidation of the geology of the country in letterpress, sections, and map, to the description and figuring of the characteristic fossils, or to the style and preparation of the books themselves.

We have, however, only the first portion of the Report before us; and that is divided into two large volumes,—one devoted to the descriptive geology, and the other to the palæontology, chiefly of the eastern counties of the State of Iowa. Messrs. Hall and Whitney were assisted by Messrs. A. H. Worthen, B. J. Hall, E. Hungerford, and E. A. Cooley in their geological explorations. They describe the country as being composed of nearly horizontal strata, of Palæozoic age, often covered by heavy drift-deposits of clay, sand, and gravel. The strata have a N.W.—S.E. strike, and dip gently, with undulations, to the N.E. The lowest rock is the Potsdam Sandstone (500 feet seen), exposed in the valley of the Upper Mississippi and its branches, especially the Upper Iowa River: above this follow the Calcareous Sandstone, or Lower Magnesian Limestone of D. D. Owen (200 feet thick); the St. Peter's Sandstone of D. D. Owen (80 feet); Trenton Limestone (100 feet), including the Black-river and Birds-eye Limestones; Galena-limestone (250 feet); Hudson-river Shales and Limestones (100 feet); [the Medina sandstone and Clinton rocks seem to be wanting;] Niagara Limestone (150 feet); Leclaire Limestone (more than 500 feet); Onondaga-salt Limestones, &c. (180 feet); Helderberg (Upper) Limestones (more than 50 feet); Hamilton Shales and Shaly Limestones (60 feet); Chemung Shales and Sandstones (80 feet); Carboniferous Limestones—Burlington Limestone (encrinital); Keokuk Limestone and Chert (Archimedal); Warsaw Limestone (Archimedal); St. Louis Limestone (concretionary); [the Ferruginous Sandstone of Missouri and the Kaskasia Limestone of Illinois are wanting;] lastly, the Coal-measures.

The lowest of these rocks occur only in the northern part of the State; the Coal-measures occupy the central and southern portions; and the whole series can be seen in section along the Mississippi by traversing the entire length of the State.

The geological formations of Iowa are those which are found to the eastward in New York and Pennsylvania; but, with one or two exceptions (especially the Potsdam Sandstone), they gradually become thinner towards the west. Thus the Cambro-Silurian rocks, from the Potsdam Sandstone to the Niagara Limestone inclusive, which are from 8000 to 10,000 feet thick on the borders of New England, or along the Appalachian chain, have a thickness of only about 1380 feet in Iowa.

The Coal-measures of the State are geologically continuous with those of Illinois and Wisconsin. They are unconformable to the older Palæozoic rocks, and overlap the edges of the slightly inclined strata of Devonian and Silurian age. As yet, in Iowa the Coal-measures have been proved to the depth of 500 feet only; whilst in Missouri they are 640 feet thick, in the Mississippi Valley 1000 feet, in Pennsylvania upwards of 6000 feet (and, including the Conglomerate, nearly 8000 feet), in Cape Breton more than 10,000 feet, and in Nova Scotia upwards of 14,000 feet. Only one or two seams of coal (from 3 to 5 feet or more thick) and a cannel-coal are worked in Eastern Iowa.

In Western Iowa the Permian formation is said to be represented by gypsiferous rocks; and the Lower Cretaceous rocks are well-developed both there and in the neighbouring Territories of Kansas and Nebraska. Mr. Hall, from the evidences already collected in the West, is inclined to believe in the existence of an extensive development of Jurassic rocks along the eastern side of the Rocky Mountains.

"It would appear," observes the author, "that, from the earliest Silurian times, the Great West, or the region of the Rocky Mountains, has been an ocean which successively received the finer sediments derived from eastern lands, or which produced within its own area the calcareous deposits,—but ever an ocean, not only to the close of the Carboniferous period, but still later through the Permian, Jurassic, and Cretaceous periods; showing apparently no evidences of dry land till about the beginning of the Cretaceous era, or perhaps a little earlier; while, in later Tertiary periods, the continental fauna and flora have been remarkably developed over the same area. Thus, while the older Palæozoic formations have been largely accumulated in the East, in successive beds, having altogether a thickness of several times the height of our highest mountains (in Iowa), they have greatly diminished in the West. At the same time, while the post-palæozoic formations are very thin or often absent in the East, they have accumulated in vast amount along the line of the Rocky Mountains, from one end of the continent to the other." (p. 141).

The physical geography of the country is described by J. D. Whitney, in chapter 1; the general geology, by J. Hall, in chapters 2 and 3; the geology of the Des Moines Valley, by A. H. Worthen, in chap. 4; the geology of certain counties, by A. H. Worthen and J. D. Whitney, in chaps. 5 and 6; and the chemistry and economic geology by J. D. Whitney, in chap. 7. It is stated that "the geological structure of the State clearly indicates that her agricultural products, her coal-mines and beds of gypsum will constitute her greatness of resources and her future wealth" (p. 145); and the lead-mines are also of importance.

Chapter 8 of this work (or part 2 of vol. i.) treats of the palæontology of the State as far as concerns the following groups of rocks,—Hamilton group, Chemung group, Burlington Limestone, Keokuk

Limestone, St. Louis Limestone, Kaskasia Limestone, and the Coal-measures. These Mr. Hall "considered more important in the present state of our knowledge,"—the Lower and Upper Silurian formations having been illustrated in Dr. D. D. Owen's Reports on parts of Iowa and the neighbouring States, and the higher groups, especially the Carboniferous Limestones, not having received so much attention. Twenty-nine elegantly engraved plates and numerous woodcuts illustrate the fossils, among which *Brachiopoda* and *Crinoidea* predominate.

This Report, as far as it extends, appears fully to meet the requirements of the State-survey organized in 1855, and provides the citizens of Iowa with clear information respecting their lands. To geologists at large it is also a very valuable work, providing means of comparison for extensive Palæozoic districts of which previously there was little exact knowledge; and we may look forward to the second volume as being even still richer in "comparative geology;" for it will not only treat of the relations of the Palæozoic rocks, with which Mr. Hall has had a life-long acquaintance, but also of the Secondary formations of the Western Territories, to the consideration of which the same eminent geologist will have brought cautious experience and dispassionate acumen.

Second Report of a Geological Reconnoissance of the Middle and Southern Counties of Arkansas, made during the years 1859 and 1860. By DAVID DALE OWEN, Principal Geologist; assisted by ROBERT PETER, Chemical Assistant; M. LEO LESQUEREUX, Botanist, and EDWARD COX, Assistant-Geologist. Philadelphia, 1860.

This Report completes the preliminary Geological Survey of Arkansas; the First Report, by Dr. D. D. Owen, published in 1858 (the result of explorations in 1857-58), having treated of the northern counties of the State. Our knowledge of the geology of this extensive tract of country has hitherto been very vague. One of the most western of the States, Arkansas has been one of the latest in being systematically surveyed by professional geologists. The Survey was placed in excellent hands; for few, if any, were so well acquainted with the soils and rocks of the central area of North America, traversed by the Mississippi, as the late Dr. David Dale Owen. Unfortunately this gifted and energetic geologist has lived but long enough, and scarcely that, to take a general view of the geological structure of Arkansas, and to point out its chief features, mineralogical and stratigraphical. But this was no light task, even with the aid of the gentlemen mentioned above as his assistants, as well as Mr. Jos. Lesley, his topographical assistant, working with him as friends only can work—with zealous co-operation. In the sad duty of preparing for the press that portion of the Report which existed only in the form of field-notes at the time of Dr. D. D. Owen's decease, his brother (Dr. Richard Owen) was cordially assisted by Messrs.

M. W. Smith, J. P. Lesley, and E. T. Cox. The last-named offers, at p. 402, a feeling memorial to the energy and worth of his esteemed friend.

In the Introduction to the Report (p. 7), and again at pp. 16, &c., we find some lucid remarks on the value of a general survey of the geology of a new country, and particularly of Arkansas. Besides establishing the chief axis and trend of the strata, that give not only the contour to the topographical features of the district, but afford a clue to the great folds or troughs in conformity with which some of the strata, appearing at one time in elevated position in the mountain-ranges, sink beneath the surface to reappear, perhaps, on the opposite side of some wide valley, such a geological reconnaissance supplies an approximate knowledge of the boundaries of the formations, enabling the geologist to predict what valuable minerals may be found within their limits, and what it would be useless waste of time to search for within the same. Thus the State-geologist here is enabled to speak with more or less certainty of the locality, nature, and origin of the brine-springs and mineral-waters, the coal-beds and lignites, the iron-, zinc-, manganese-, lead-, and copper-ores, the limestones, marbles, clays and marls, slates, hone-stones, and building-materials, paints, nitre-earths, crystals, &c., of Arkansas.

"Yet Arkansas," wrote the hopeful geologist, in the introductory portion of this his posthumous Report, "is a young State; and her geological survey is in reality only fairly commenced. If thus early in this work we are able to report such flattering prospects, what may not be anticipated by thorough and minute detailed surveys?"

In the Agricultural Survey, numerous analyses of the soils of this State were made, which induced Dr. Owen to believe that its soils generally are equally rich in fertilizing ingredients with those of the neighbouring States, and that its best bottom-lands are, in truth, richer. More mountainous than Iowa, Wisconsin, and part of Minnesota, Arkansas has a greater abundance of timber, and a shorter winter. Pine-timber is of very general growth in this State, due probably (says the author) to the diffusion of silicate of potash in the soil. "So peculiarly indigenous does the yellow pine appear to be to the Arkansas soils, that you will even find it growing in river- and creek-bottoms, side by side with the Gum, and, on the argillaceous slopes, associated with the Beech." Poplar-timber is said to be entirely absent, except on quaternary soil at one locality. The Cretaceous soils of the south-west counties of the State, highly charged with lime, are peculiarly congenial to the Osage Orange or Bois d'Arc. M. L. Lesquereux enumerates eight species of Grape (p. 353) as having been found in Arkansas, in some localities with fine growth; but the people do not seem to appreciate the Vine (p. 329).

Protruded masses of igneous rocks (granitic, hornblendic, and augitic), of small extent and distant from each other, occur on the waters of the Fourche (Pulaski county), in Saline county, and at Magnet Cove, in Hot Spring county; these lie on a N.E.-S.W. line. The general strike of the stratified rocks is stated to be most probably nearly E. & W. These are greatly disturbed and altered near this

granitic axis; and not only here, but over a very wide area removed from this locality, the shales, sandstones, and limestones occur in a greatly metamorphosed state, highly tilted, and often traversed by mineral veins*. The tilted edges of the sandstones and shales are crossed along the roads for miles, and, though there are reversals in the dip evident in places, they must be of immense thickness. "They all seem to be of the age of the Millstone-grit, or, at least, not lower than the base of the Subcarboniferous group, because they overlie rocks of Devonian date, and have intercalated, towards their base, limestone and black flint, which, though often brecciated and metamorphosed into a black-veined marble, are undoubtedly of the same age as the black limestone and flint of Wiley's Cove and Shield's Bluff, which belong to the date of the (Productus-) Archimedes-Pentremital beds of the Subcarboniferous group." They appear to immediately underlie the true Coal-measures. The induration of these strata in Arkansas the author attributes to the highly heated gases, vapours, and alkaline siliceous water,—the various degrees of change observable arising from differences in the intensity and phases of such agencies. The *pervious* sandstones are much more altered than the *impervious* shales. The latter are, for the most part, only locally indurated into hard slates, undergoing rapid disintegration on exposure. Sometimes they are permeated with veins, and network of veins, of milky quartz. Rarely the siliceous shales become good roofing-slate. The sandstones, over many wide areas, are not only indurated, but often completely changed in structure, passing into quartzite, chalcedonic chert, flint, and novaculite. South of the parallel $34^{\circ} 30'$, in Hot-Spring, Saline, Montgomery, and Polk counties, there is less limestone intercalated with the slates, and these have more quartz-veins, generally running at an acute angle with the strike, which most frequently is W. 20° S. and E. 20° N.

The Coal-measures of Arkansas are more fully treated of in the First Report, 1858. They belong to the Millstone-grit, and lie below the horizon of "No. 1 Coal" of the Kentucky sections. One or two hundred feet of shale overlie massive conglomerates or thick-bedded sandstones; and these overlie reddish and dark-coloured shales, upwards of 300 feet thick, which, in their upper part, contain thin seams of coal. The shales appear to have been thrown into wide troughs before the deposition of the sandstone. The Arkansas Coal-field is traversed by the Arkansas River; the strata are nearly horizontal; it contains several thin seams of coal, and there are some from 4 to 5 feet thick. From these Coal-measures M. Lesquereux has obtained upwards of forty species of plants, belonging to twenty-five genera; also the wing of an Insect (*Blattina vetusta*, Lesq.). These fossils are described by M. Lesquereux, and figured in five elegantly engraved plates.

* Another granitic axis, reaching the surface on a branch of the Spavinaw Creek, beyond the north-western limits of the State, probably underlies the lead-bearing Subcarboniferous Limestone of the north-west counties of Arkansas and the south-west counties of Missouri.

As in the attempted delineation of the older rocks of Arkansas, so also in the supposed area of the Cretaceous strata, the published maps are very incorrect. "I have not been able to detect (says Dr. Owen) any symptoms of Cretaceous strata, even in deep wells, any further north in Arkansas than Clark county, about two and a quarter miles north-west of Archidelpia, *i. e.* near the line between townships 7 and 8 south, in about latitude $34^{\circ} 6'$. At the fine section exposed on the Arkansas River, at the 'White Bluffs,' *i. e.* about latitude $34^{\circ} 27'$, beds of Quaternary date occupy the higher part of the bluff, while the lower 50 or 60 feet, extending down to the low-water mark of the Arkansas, is most decidedly Tertiary shell-marl of Eocene date, affording the following species:—*Cardita densata*, *Fusus magnocostatus*, *F. Pittonii*, *Corbula Alabamensis*, *Monoceros vetustus*, and others undetermined. Even at a point on the river-bank where a considerable disturbance and tilting of the strata are conspicuous, nothing lower in the geological series can be seen than Eocene Tertiary."

In Southern Arkansas immense numbers of very large oyster-shells lie strewn on the ploughed lands, where the Cretaceous strata come to the surface—*Exogyra costata*, sometimes weighing upwards of four pounds, and *Ostrea vesicularis*. These are collected and made into a superior lime. Bones of sharks and saurians are also found. Dr. Koch collected many bones here, and removed them to Berlin. Two plates (7 and 8) of Cretaceous fossils, some of which are undescribed, accompany the Report.

The Tertiary beds are best seen in section at the White Bluffs: they yield some limestone for lime-burning, and abundance of shell-marl, good for manure; also, in some places, gypsum, large masses of iron-ore, and thick beds of lignite. The last, as well as some lignites occurring in the Quaternary deposits, yield, by distillation, from thirty to forty-five gallons of crude oil to the ton of 2000 lbs.; and for this purpose the lignites are likely to be more profitable than as fuel. A plate illustrating the kind of leaves (of dicotyledonous trees) found in the Tertiary lignites of the "Chalk-banks" of the Mississippi and the red shales of Tennessee is given by M. Lesquereux (pl. 6), who here figures and describes three new species of *Magnolia*, *Quercus*, and *Rhamnus*. Plate 9 illustrates some of the Tertiary shells and fish-teeth.

To the Drift or Quaternary age are referred numerous and extensive drift-deposits, composed mostly of quartz, sandstone, and hard shales and slate; sometimes these are very thick, consisting of coarse material, and containing large blocks. These Drifts have no connexion with the Northern Drift, though possibly partly contemporaneous with it; but have been due, in Dr. Owen's opinion, to the repeated and long-continued movements of the rocks one upon another, during periods of disturbance and upheaval; and some of the Drift may be "of comparatively recent date, perhaps as new as the date of the rise of the Quaternary beds of the Western States out of the great lake-like expansions of fresh water in which they were accumulated."

The agricultural geology of the State (pp. 42, &c.) has received considerable attention from Dr. Owen and his assistants; and the soils have been extensively analysed. Dr. R. Peter's report on the chemical analysis of soils, subsoils, under-clays, clays, and nitre-earths, with some general observations on soils, occupies pp. 163–294.

The thermal waters of Hot-Spring county are fully treated of at pp. 18, &c., and at pp. 101, &c. Silica and carbonate of lime are their most abundant mineral constituents. Their temperature ranges from 100° to 148° Fahr. They issue, with much free carbonic acid, mostly from a snowy-white chalcedonic novaculite (the “Ouachita oilstone,” or “Arkansas whetstone”), in upwards of forty springs, on a ridge (Whetstone Mountain) about 250 feet above the valley, and deposit much calcareous tufa. The novaculite varies in character, is much fissured and veined with quartz. In Montgomery county, some twenty miles distant, the sandstones are less altered, but have their joints and planes of stratification filled with fine clusters of crystals of silex, as much as 5 or 6 inches in length, and of unsurpassed purity. The valley below the springs is occupied with silicified slate, traversed by veins of serpentine. No igneous rock is exposed nearer than ten miles off, at Viga Creek, on the borders of Magnet Cove, famous for its magnetic iron-ore and great variety of minerals, including titanite acid (Brookite or Arkansite).

Artesian wells are treated of in chap. 3, including those of Louisville and St. Louis,—the former 2086 feet, the latter 2199 feet deep. Mention also is made of several of the best-known in Europe.

This Report is illustrated with a chart of the principal hot springs in Hot-Spring county, with several plates and woodcuts illustrating the topographical features, and with the engraved plates of fossils already noticed above. M. Leo Lesquereux's Report on the Botany and Palæontology of the State (pp. 295–399) comprises a systematic catalogue of the plants of Arkansas, with useful notes appended. There is also a good index to the whole book.

This useful work must have been very welcome to the inhabitants of Arkansas, and is full of interest to geologists abroad and at home. Its getting-up does credit to the State, whose late Governor, his Excellency E. N. Conway, appears to have warmly and judiciously patronized the Survey. The geological results of the reconnaissance are worthy of the veteran geologist and his assistants; and it is fervently hoped that the detailed survey of the State will be strenuously proceeded with under equally good auspices as soon as peace shall have again calmed existing disturbances in the distracted States of North America.